UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MANAGEMENT AND LEADERSHIP PROJECT: SYNERGISTIC BIOSOLID MANAGEMENT

Prepared by:
David Loomis
Environmental Planner
Carson City District Office

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Carson City District Office
1535 Hot Springs Road, Suite 300
Carson City, Nevada 89706-0638
(702) 885-6100

In reply refer to:
1400-412
(NV-03337)

Memorandum

APR 09 1993

To: Service Center Director (SC-630)

From: State Director, Nevada

Subject: Management and Leadership Program

I am pleased to submit the completed Management and Leadership Project for David Loomis, Carson City District Natural Resource Specialist. The project "Synergistic Biosolid Management," involved the application of municipal sewage sludge biosolids to a heavily disturbed mining area to enhance mineland reclamation. This was the first application of its type in the Great Basin. By establishing the feasibility of this process, it is expected to lead to more widespread use of innovative waste recycling and ensure that the BLM remains on the cutting edge of reclamation technology.

Billy R. Templeton

Attachment
1. Project Report (2 ea)

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Management and Leadership Project
Synergistic Biosolid Management

Synergist \-jest*n* -s[NL *synergista,* fr. Gk *synergost* + L *-ista* -ist] 1: an agent that increases the effectiveness of another agent when combined with it

In June, 1988, consultants for the Truckee Meadows Wastewater Reclamation Facility contacted Bureau of Land Management staff in the Carson City District about using public lands for disposal of sewage sludge biosolids. At the same time, Carson City District staff were engaged in efforts to reclaim lands that had been disturbed by mining. They wondered if mineland reclamation and wastewater reclamation efforts could be combined to increase the effectiveness of both procedures.

Background

Waste disposal has been a critical problem throughout human history. As population growth continues, the problem becomes more critical. The United States has led the world in the technology to develop resources. Now it has the opportunity to lead the world in the technology to preserve and manage natural resources. Our challenge is to develop new techniques to extract natural resources from our public lands while protecing our common environment.

Environmental protection and economic growth are not separate challenges. By creative application of current public land management technologies, environmental damage from natural resource development and human waste disposal can be limited while enhancing economic development through use of that waste as a resource. Integrated management of waste products and natural resource extraction is a synergistic approach to achieving sustainable growth.

Institutional growth is the key to merging environmental and economic concerns in decision-making. This can only be accomplished through acceptance of more broadly defined land management goals that consider the needs of society as a whole. Land application of municipal sewage sludge biosolids can help to meet those goals.

Sludge Biosolid Management

Sludge is the residue removed during the treatment of municipal wastewater and domestic sewage. It is classified as regulated waste because of its trace metals and potential for pathogens. It is not classified as a hazardous waste. Biosolids are those sludges that meet EPA criteria for beneficial use.

Communities have traditionally managed sludge by dumping barge loads into the ocean, lagooning it in lined ponds, and dumping it in sanitary landfills. New regulations for landfills have greatly increased their cost and decreased their availability. Landfills all across the country are filling up far faster than planned. Many are leaching poisonous waste water into local streams and aquifers. The large amount of water in sludges increases the potential for such leaching. Furthermore, the disposal of human waste in existing landfills reduces the already limited public acceptance of planned solid waste disposal sites.

Fortunately other options for sludge disposal are available, in large part due to the federal government's policy of promoting cost effective use of recycled materials in American society. Several decades of experience with sludge biosolids have shown that they are a valuable resource. Fertilizer value alone amounts to $60 per dry ton. Recycling sludge biosolids through beneficial use projects also can serve natural resource management and other community goals.

Beneficial use projects generally involve land application. Hundreds of studies have been conducted, and several thousand wastewater reclamation facilities in the United States are recycling their sludge biosolids through land application. In Maryland, for example, 85% of the sludge produced is applied to the land. In Washington, D.C. over 800 tons of sludge biosolids were used to reestablish the White House lawn (EPA, 1989).

Biosolid land applications are intended to improve soil conditions. These improvements are likely to increase ecosystem productivity. They can lead to significant improvements in soil stability and in the structure and diversity of plant and animal communities. Thus, land application of sludge biosolids can promote biodiversity.

Sludge biosolids are soil conditioners that improve nutrient uptake, increase water retention, permit easier root penetration and improve soil texture. They also contain nitrogen and phosphorus, essential plant nutrients. Municipal sludge biosolids provide both quick release and long term nitrogen. Ammonia and inorganic nitrogen are dissolved in biosolid liquids and are therefore directly available for uptake by plants.

Microorganisms provide slow release nitrogen by converting organic nitrogen to a plant usable form.

A study of the use of sludge for Pennsylvania coal mine reclamation found that on sludge amended sites plant growth was greater on 5 year old sites than on 2 year old sites. No indication of site deterioration was evident. Total nitrogen remained constant on all sites. Yield, organic matter, and nitrogen were all greater on sludge amended sites than on sites amended with fertilizer. The study concluded that sludge enhanced soil development, biodiversity and ecosystem recovery as compared to fertilizer (Seaker and Sopper, 1988).

Without annual maintenance, vegetative cover on sites treated only with fertilizer often deteriorates because microbial development is slow and nutrient cycling never becomes fully operative. The use of sludge as an amendment eliminates the initial lag period that occurs on conventionally reclaimed sites. During this period, plant growth and microbial activity are at a low level, neither sufficient to support the other. Sludge amendments quickly increase the numbers and action of microorganisms. Their activities enhance the development of a soil environment that augments plant growth (Trexler, et al. 1992).

In the west, sludge biosolids are particularly beneficial. Since they provide mulching as well as nutrients, they are less dependent on precipitation for effectiveness. In a Bureau of Land Management sponsored study of sludge biosolid application to degraded rangeland in New Mexico, major improvement in microbial activity was recorded. That study concluded that although the biosolids directly supplied nutrients to the soil, the decomposition of the biosolids through increased microbial activity also supplied valuable nutrients for plant growth.

These and other studies indicate that biosolids can improve degraded sites through physical, chemical and biological action. They can improve physical characteristics through reduction of rain-splash and sheet-flood erosion and subsequent increases in infiltration and water retention. Chemical processes include addition of soil nutrients. Sludge improves biological action by adding carbon required by soil microbial communities to process nutrients (Dennis and Fresquez, 1989).

Biodiversity is affected by the higher levels of soil nutrients and organic material resulting from application of biosolids. This can either enchance or degrade particular species. Those species better able to adapt to the new conditions will thrive at the expense of less adapted species. Whether these modifications of biodiversity are positive or adverse can only be evaluated on a site specific basis. If the land management objective is to revegetate a heavily mined or otherwise disturbed area that

supports little or no diversity, then the changes are most likely positive. On the other hand if the land management objective is to maintain the ecological status quo then the changes would reduce biodiversity.

The most significant environmental problem associated with land application of biosolids is the potential for bioaccumulation of metals. High application rates of sewage sludge may result in increased plant uptake of heavy metals and contaminate the food chain.

This issue has been the subject of extensive research. Studies have found that under some conditions, certain species of plants and animals can concentrate metals from sludge biosolids in their tissues. This has typically occurred when application rates were high and the biosolids contained high concentrations of metals. Species low on the food chain have been the subject of most of the research. Contaminants found in their tissues did not have harmful effects on those organisms. Contaminant levels in those organisms were generally within background levels in areas without sludge amended soils (EPA, 1991).

Several soil factors regulate plant uptake of metals. Of these, pH is probably the most significant. On western alkaline soils, pH levels are less of a factor and maintaining soil pH at 6.5 or greater limits the availability of most metals to plants.

Cation exchange capacity measures a soil's ability to hold and exchange positive ions such as calcium, magnesium, potassium and some heavy metals. This ability is affected by pH. Soil clays and organic matter usually have negative charges that attract positive ions. Therefore, soils high in clay and organic matter will be higher in soil cation exchange capacity when pH is nuetral or alkaline and will hold a greater quantity of metals.

Other soil reactions that affect the availability of metals are sorption, precipitation and complexation (chelation). Under proper pH levels, these soil characteristics limit the solubility of metals (Trexler, 1992).

Controlled application rates limit the bioaccumulation of metals. The amount of biosolids applied can be balanced with the expected rate of nutrient uptake according to the soil characteristics listed above. Application rates can be adjusted to prevent bioaccumulation by monitoring the composition of the biosolids. State and federal agencies have developed regulations and guidelines for the environmentally safe use of biosolids. Those guidelines apply to biosolids with moderate metal concentrations when the biosolids are applied at agronomic rates based on nitrogen and phosphorus uptake.

Another concern related to the presence of metals in biosolids is

the potential for contamination of groundwater. But the downward movement of metals is limited because they are relatively immobile in soils. Essentially all the applied metals remain in the upper 5 to 10 inches of the soil. This is the depth of tillage. Maintaining the soil at pH 6.5 or above further reduced the movement of metals.

Biosolids also contain fecal coliform and pathogens, or human disease vectors. Pathogens gradually die after the biosolids are applied to the soil, but this decrease is not instantaneous and contact with people, wildlife and livestock is possible. It is impossible to exclude wildlife completely, but EPA regulations require the use of a process to significantly reduce pathogens for all biosolids used in land applications. This process can occur through aerobic digestion, air drying, anaerobic digestion, composting, or lime stabilization. In addition, public access to the site must be controlled for one year and grazing by livestock is prevented for at least one month after application.

There is no existing scientific evidence of significant human health risk from sludge biosolids that are produced and applied to land in compliance with EPA regulations. Also, the weight of scientific evidence supports the conclusion that beneficial use of biosolids that is permitted by EPA does not present a significant risk to the environment.

Federal land management agencies have not commonly used municipal sludge biosolids on public lands. The few times it has occurred have been the result of the initiative of local managers. Employing non conventional procedures always involves some degree of risk management. Yet failing to test new ideas also poses risks if it limits future management options. The risk of testing new practices needs to be weighed against the risk of limiting future options.

In 1991, an interagency task force on the beneficial use of sludge recommended that in evaluating the application of biosolids on federal land the agencies should:

1. Determine whether adoption of the proposal would comply with applicable law, would be consistent with the agency's long term land management objectives, and would conform to the agency's approved land management plans.

2. Determine if predicted effects will promote the agency's resource management objectives (e.g. land reclamation).

3. Assess the proposal based on existing credible scientific information. The environmental analysis of a specific project must consider sludge characteristics, the resources and the land to which it is proposed to be applied. In the absence of sufficient scientific information to make a

reasonable decision, the agency should consider a pilot project designed to produce the necessary information to make an informed decision.

4. Evaluate ways to reduce the agency's costs, such as cost reimbursement and applicant monitoring of the project.

Problems with Great Basin Mine Reclamation

There are two products associated with any mining venture, the minerals extracted and the reclaimed mining site. While major accomplishments in mineral extraction have occurred for the last few decades, only modest success can be claimed for Great Basin mineland reclamation.

The Great Basin is a region of interior drainage valleys separated by generally north-south tending mountain ranges. It has some of the most difficult lands to successfully revegetate after mining disturbance. Typical climatic factors limiting successful revegetation in the Great Basin include variable and low precipitation, extreme variation in diurnal temperatures, low relative humidities and severe desiccating winds throughout the growing season.

Soils of the Great Basin are highly variable, ranging from those typical of sagebrush steppe, to those found in salt deserts. Edaphic limitations unique to the Great Basin include soils that contain high concentrations of salts, that are either sandy or rocky with low water holding capacities, or those high in clays with poor drainage and low permeability.

Mine spoil material can be considered an ecologically primitive soil. It is a poor medium for plant growth and even when treated with fertilizer, often has a low potential for supporting desirable stands of vegetation. Typically, it contains little organic matter, microflora or nitrogen detectable by chemical analysis. Without added amendments the raw spoil material often fails to support adequate vegetation within suitable time frames to meet minimum standards for reclamation.

Many of these shortcomings can be overcome by proper stockpiling of topsoil. Unfortunately, for older mines, stockpiling of topsoil rarely occurred. In many areas of the Great Basin soils are very skeletal with little or no topsoil available for stockpiling. In such cases, subsoils and other geologic material with few desirable qualities for plant growth are often stockpiled as a substitute. Even where stockpiling has occurred, problems remain. The stockpiles are subject to both wind and water erosion. When topsoil is stockpiled there is often a change in both the physical and chemical properties of the soil from mixing of the soil horizons. This can decrease organic matter, cation exchange capacity and plant available nitrogen. Also, the microbial activity of the stockpiled soils decreases significantly as the length of storage increases.

Without successful reclamation, mining operations can replace large areas of land with soil materials containing little organic matter and having poor chemical and physical properties and low fertility.

Pilot Study Description

No scientific studies of sludge biosolids application for mine reclamation in the Great Basin exist. However, agricultural use has begun. Biosolids from the Truckee Meadows Water Reclamation Facility are being successfully used by Empire Farms in Washoe County for agricultural fertilizer.

Nevada BLM policy fully supports the use of biosolid fertilizer for mined land reclamation (IM NV-91-241). Such projects meet BLM's goals to minimize waste, maximize recycling and foster new reclamation technologies.

Project Development

In June, 1988, consultants for the Truckee Meadows Water reclamation facility contacted Carson City District staff regarding disposal of municipal sludge biosolids on public lands. District staff identified a number of significant problems with the sites proposed by the consultants and the proposal eventually was withdrawn. However, the District was also involved in reclamation of minelands and investigated the feasibility of using municipal sludge biosolids to enhance reclamation opportunities. After lengthy research on the subject, the author prepared a staff proposal for use of sludge in mine reclamation.

The proposal noted that sludge had been used in the eastern U.S. for years and had been proven to enhance reclamation efforts by promoting biodiversity. It also noted the potential for contamination by hazardous materials. The proposal was submitted for internal review in October, 1989. In response, the Washington Office issued instruction memorandum WO-90-228 (January, 1990). It stated that recent field inquiry resulted in the need to develop a definitive policy on disposal of sludge on public land. After meeting with the EPA, BLM determined that due to the risks and problems associated with sewage sludge and the nature of the lands and types of activities conducted under BLM management, the disposal of sludge on public land was prohibited. Risks included bioaccumulation of metals, potential drinking water contamination and liability problems.

Other federal agencies also struggled with the issue. Later in 1990 the Office of Management and Budget convened an interagency task force to develop a consistent policy on the beneficial use of sludge on federal lands. After extensive research and deliberation, the task force concluded that there were no significant dangers to human health or to the environment from proper use of sludge. They issued a beneficial use policy in July 1991 encouraging federal land managing agencies to use sludge to enhance federal lands. In August, 1991, the BLM Nevada

State Office followed with a policy to fully support the use of sewage sludge for mined land reclamation. It noted that the correct application of biosolids to mining meets several BLM goals such as leading the nation in reclamation technology, minimizing waste, maximizing recycling, fostering new technologies and ensuring proper reclamation.

With this change in policy the author selected a sludge biosolid pilot study as his Management and Leadership program project. The project had short and long term objectives. The short term objective was the subject of the Management and Leadership program. It was to demonstrate the feasibility of applying sludge biosolids in mineland reclamation. This objective was met when the biosolids were applied in November, 1992. The long term objective is to determine how well biosolids function as a soil amendment in mineland reclamation. It will take about five years for that objective to be met.

Following approval to proceed with the project at the Management and Leadership session, contacts were made with the University of Nevada Las Vegas Harry Reid Center for Environmental Studies (UNLV). UNLV had previously inquired about BLM participation in a biosolid study project. UNLV agreed to participate as a cooperating agency in the proposed project and indicated that it had access to biosolids from the Truckee Meadows Water Reclamation Facility.

The search for an appropriate study site was the most time consuming aspect of the project. After an extensive search, a site was selected in July, 1992. The site, located at the Butcher Boy Mine, consisted of three mine tailings ponds associated with previous placer gold mining operations. The mine operator, American Resources Corporation (ARC), agreed to prepare the site for the study project by recontouring and covering the ponds with mine overburden materials. ARC also said that it would provide any equipment needed in the biosolid application process. In return, it requested that we include one test plot amended with zeolite. ARC wanted to find out if zeolite would reduce heavy metal concentrations, increase the soil's cation exchange capacity, and improve the potential for plant growth. BLM agreed to test the zeolite.

Following site selection, contacts were made with various Washoe County and State agencies. All agreed to support the project if the Nevada Division of Environmental Protection (NDEP) issued a water pollution control permit. Negotiations with the NDEP were initiated in September, 1992. NDEP staff were concerned about the potential impact of flash flooding on the study site. However a site visit yielded a conclusion that the site was located on high ground and that proper berming was in place to minimize any potential damage. A second concern expressed by NDEP involved the potential for early germination and freezing

associated with fall seeding. As a result, BLM agreed to testing spring seeding on one sludge amended plots.

Concurrently with the NDEP permitting process, BLM conducted an environmental assessment process. The assessment concluded that the project would have no significant risks to human health or the environment. It identified the potential for flash flooding. The assessment noted that should flash flooding occur before vegetation becomes established on the test plots, the biosolids could be washed down-slope. It considered this unlikely since the test plot area contains no drainages and the mine operator has restored a drainage to the north to route any floodwater away from the site. Furthermore, given that the test plots amounted to less than one tenth of one percent of the 18 square mile Dodge Flat watershed; that the nearest surface water, the Truckee River, is more than 4 miles away; and that the biosolids have low concentrations of potential pollutants, any biosolids would be mixed with native material and diluted to the extent that no adverse environmental impacts would occur. It also noted that the pilot study would likely aid revegetation of the site and result in net beneficial environmental impacts.

A 30 day public review of the environmental assessment yielded six comments. Washoe County and the State of Nevada submitted comments identifying no objections to the pilot study. The Sierra Club expressed its enthusiastic support. The Mineral Policy Center indicated that the assessment contained insufficient information regarding the potential for bioaccumulation of trace metals. Finally, the Pyramid Lake Paiute Tribe objected to the project based on the potential for flash floods to transport the biosolids to the Truckee River and Pyramid Lake, thereby polluting the river and affecting the endangered cui-ui fish and threatened Lahontan cutthroat trout.

Because of these comments, BLM sent further information on bioaccumulation to the Mineral Policy Center. BLM also initiated informal consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act. In response to that consultation, the Fish and Wildlife Service concluded that if contaminants from the sludge biosolids reach the Truckee River, they may enter Pyramid Lake and impact both the cui ui and Lahontan cutthroat trout. They noted that even though the sludge application rates were within EPA guidelines for land application, toxicity levels of heavy metals or other sludge constituents on the fish are unknown. However, they also noted that the proposed site was five miles from the river and outside any drainages, that a diversion structure and an existing arroyo would rout meteoric waters away from the site, that the site was on a topographic divide between drainages, and that pollution of the river through groundwater transport was unlikely because the sludge constituents are immobile in soils. Therefore, the Service concurred with BLM's determination the pilot study was

not likely to adversely affect the cui-ui or Lahontan cutthroat trout.

Following notification of this decision and NDEP's permit approval, the BLM issued a finding of no significant impact and decision record approving the pilot project in October, 1992. Nobody protested the decision.

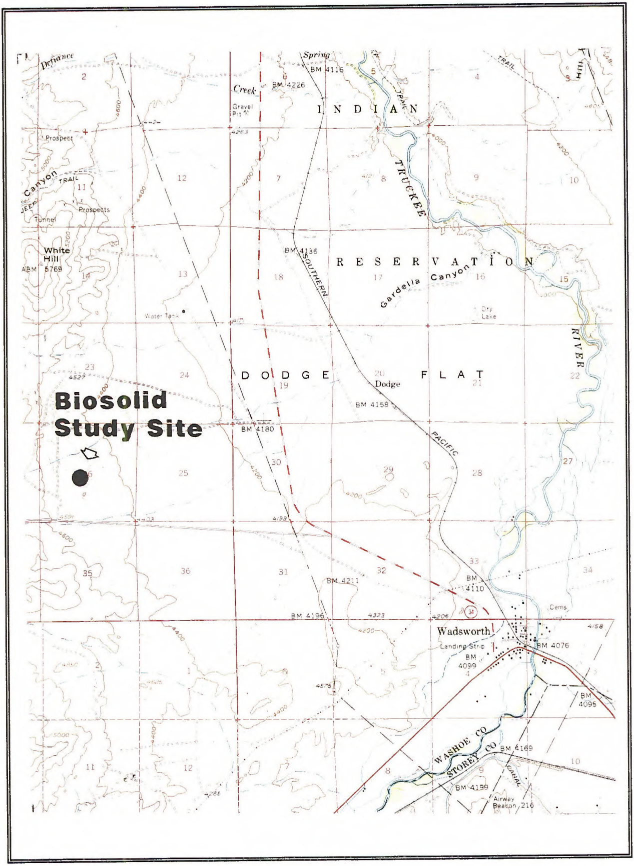
Project Location

The area selected for the pilot project is part of American Resource Corporation's (ARC) Butcher Boy mine located in Sections 26 and 27 T. 21 N, R. 23 E. The Butcher Boy Mine is on an alluvial fan on the southeast flank of the Pah Rah Range, northwest of Wadsworth, Nevada (Map 1). Much of the site was disturbed by surface mining, but unmined areas have gentle slopes vegetated primarily by shadscale and greasewood. A few ephemeral stream channels cross the property, and a 60-foot high volcanic butte adjoins the southeast side of the mine (Map 2). The test plot was constructed on three tailings ponds separated by low, earthen containment dikes. The regraded ponds provided a flat area of approximately 10 acres.

Biosolid Source

Through an agreement with UNLV, the Truckee Meadows Water Reclamation Facility provided the biosolids. As part of the reclamation process, solids from municipal wastewater are physically separated from the liquid stream by gravity sedimentation. After processing through clarifiers, biosolids are subjected to an anaerobic digestion process that destroys pathogenic organisms and reduces biodegradable solids. Anaerobic digestion employs microorganisms that convert organic material to methane and carbon dioxide in the absence of air. The digester tank desstroys most the biodegradable organic matter and 99.8 percent of the pathogens. The biosolids resulting from anaerobic digestion are *relatively* odor and pathogen free.

Map 1 General Location



Map 2 Study Site

The biosolids from the Truckee Meadows Water Reclamation Facility are far below the national averages for heavy metals of significance. Only selenium exceeds the national average.

Table 1
Trace Metal Content of Truckee Meadows Biosolids
July, 1992

Metal	**National Average ppm**	**Concentration ppm**
Cadmium	9.9	0.92
Chromium	119	14.30
Copper	741	300.00
Lead	134.4	21.70
Mercury	5.2	0.12
Nickel	42.7	14.30
Zinc	1202	370.00
Arsenic	9.9	6.40
Selenium	5.2	14.00

The sludge is of high quality and can provide substantial quantities of nitrogen and phosphorus. Total nitrogen in the biosolids from the Truckee Meadows facility is 4.8%. Total phosphate is 4.0%.

The viability of the biosolids as fertilizer was demonstrated by the success of the Empire Farms operation. That project involves the use of biosolids for the Truckee Meadows Facility in a land application program to fertilize a garlic farm near Empire in northern Washoe County. That project recently won a second place national award from the Environmental Protection Agency. Prior to the farming operation, the biosolids were dumped in a landfill. This wasted a valuable soil amendment and depleted valuable landfill space.

Project Implementation

Prior to the application process, BLM staff obtained monitoring results from the nearest down gradient well, installed a precipitation measuring device and mapped (Figure 1) and sampled (Photo 1) the pre-existing soils.

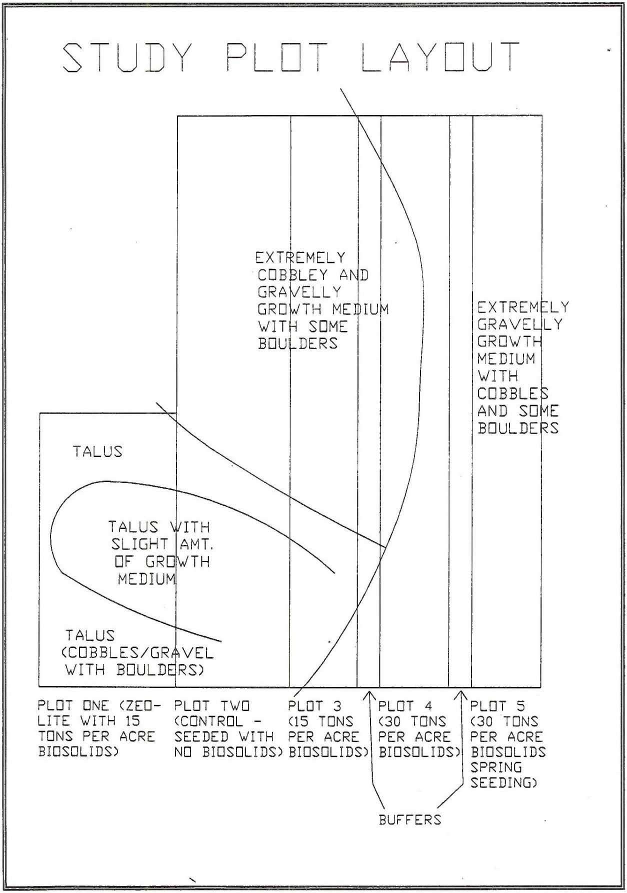


Figure 1 Site Layout

Preliminary sampling yielded the following soil data:

I. The pH of the soil was 8.0 or medium alkaline - well above the EPA minimum of 6.5.

II. Organic matter was almost non-existent - therefore nitrogen release was only 34 lbs per acre.

III. Cation exchange capacity was low at about 15. This is within EPA standards and was used to determine application rates.

Biosolid application was initiated on November 18, 1992. Sludge transport trucks operated by Shuster Enterprises under contract to the Truckee Meadows Water Reclamation Facility deposited the biosolids on site (Photo 2).

Transportation safety regulations required cleaning of remaining biosolids from the trucks. BLM fire crew sprayed out each truck with water from a BLM water tanker (Photo 3).

A backhoe/front end loader provided by the mine operator loaded the dumped biosolids into the sludge spreader (Photo 4). That equipment proved unsatisfactory. Therefore BLM transported its own small front end loader to the site. It proved much more satisfactory (Photo 5).

Carson City District operations staff loaded the biosolids into a Ford-New Holland Model 308 organic spreader (Photo 6). At the request of UNLV, Empire Farms donated the use of the spreader, farm tractor, and equipment operator. The spreader has a capacity of 2,300 gallons or 11 cubic yards per load. It spread the biosolids over four one-acre test plots. A total of 16 spreader loads each were applied to test plots 4 and 5. This amounted to 30 tons per acre on a dry weight basis. It spread test plots 1 and 3 with eight loads each for a total of 15 tons of biosolids per acre (Photos 7 and 8). Plot 2 served as the control for the study with no biosolids applied.

The two primary constituents of concern were copper and cadmium. Under the 40 CFR 257 regulations in effect during 1992, only 4 percent of the maximum allowable copper was applied to the test plots at the 30 ton per acre rate. The loading rate for copper at 30 tons per acre was 22 lbs. per acre, well below the allowable 504 tons per acre under the 257 regulations. At 30 tons per acre, a total of .06 lbs. per acre of cadmium were applied. The allowable loading rate is .45 lbs. per acre.

Following the spreading process, a five bladed ripper incorporated the biosolids into the soil (Photos 9 and 10). BLM

contracted with a private mine reclamation contractor to rip the test plots.

After the ripping treatment, District staff seeded the plots as outlined in Table 2

Table 2
Seeding rated for Plots 1,2,3 and 4*

Species	Seeding Rate lbs/acre	Pure Live Seed Equivalent lbs/acre
Fourwing Saltbush	8.0	4.0
Siberian Wheatgrass	5.0	4.7
Hycrest Crested Wheatgrass	5.0	4.5

* Plot 5 will be seeded in the spring of 1993 to test the response of sludge amended plots to spring seeding.

BLM staff seeded the plots with a Polaris ATV equipped with a rear mounted broadcast seeder (Photos 11). After seed application, they dragged the plots with a spring harrow to incorporate the seeds into the growth medium (Photo 12).

Although the area is not grazed by livestock or located in a heavy wildlife use area, District staff installed utilization cages to ensure accurate measurement of future vegetation growth (Photo 13). The final step was to post the study site with warning signs (Photo 14). Although the area is not readily accessible to the public, this extra precaution was deemed appropriate.

Photo 1: BLM Scientists sample soil prior to biosolid application

Photo 2: Sludge biosolids delivery

Photo 3: Cleaning sludge trucks

Photo 4: ARC donated backhoe/front end loader

Photo 5: BLM front end loader

Photo 6: Biosolid spreader donated by Empire Farms

Photo 7: Spreading biosolids on plot five

Photo 8: Spreading biosolids on plot four

Photo 9: Delivering contract ripper

Photo 10: Ripping biosolids into the soil

Photo 11: Loading seeder

Photo 12: Harrowing seeded study plot

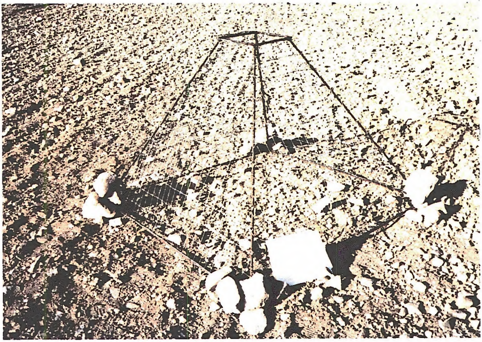


Photo 13: Utilization cage on plot three

Photo 14: Warning sign

Conclusion

Several decades of experience with sludge biosolids have shown that they are a valuable resource. Biosolids are those sludges that meet EPA criteria for beneficial use. Beneficial use projects generally involve land application. They are intended to improve soil conditions by improving nutrient uptake, increasing water retention, easing root penetration and improving texture. They also contain nitrogen and phosphorus, essential plant nutrients. These improvements increase ecosystem productivity and biodiversity, particularly in heavily mined areas where diversity is limited.

Land application of municipal sludge biosolids is not risk free. The biosolids contain metals that can be concentrated at toxic levels in plant and animal tissue. They also contain pathogens, or human disease vectors. However, when properly managed under EPA guidelines there is no significant risk of bioaccumulation of metals or harm to human health.

Federal land management agencies have not commonly used municipal sludge biosolids on public lands because of the risks outlined above. This reluctance has in itself posed risks since it has limited future management options.

One of those options has been mineland reclamation in the Great Basin. Although there are many successful reclamation efforts in this region, significant problems remain. Topsoil is often skeletal and lengthy storage degrades soil characteristics. Unspoiled areas of land in the Great Basin subjected to open pit mining have now been replaced with soil materials containing little organic matter and having poor chemical and physical properties and low fertility.

This biosolid pilot study was the result of a 1988 proposal for land application of sludge on public lands in Warm Springs Valley. Although that project was not approved, it raised the issue of biosolid management and led to the conclusion that it could be used in a synergistic manner with ongoing mineland reclamation. Preliminary inquiries regarding the pilot study were rejected due to concerns about the risks associated with application of biosolids to public lands, but eventual BLM approval was obtained. The proper application of biosolids in mine reclamation meets BLM goals to lead the nation in reclamation technology and recycling waste.

The pilot study has two phases. Phase one was the subject of the Management and Leadership program. Phase one of this effort was successfully completed with the application of the biosolids to public lands in December, 1992, proving that biosolids could be

used for mineland reclamation projects in the Great Basin. Much work remains to be done for Phase Two of the project, which is to determine the effectiveness of the biosolids.

Participating/Review Staff

U.S. Bureau of Land Management, Carson City District Office

David Loomis	Environmental Planner
Craig McCaa	Reclamation Specialist
Jim DeLaureal	Soil Scientist
Dan Jacquet	Geologist
Carla James	Geologist
Jim Quella	Engineering Equipment Operator
Gene Moore	Engineering Equipment Operator
Mike Davis	Fire Station Manager
Tom Baker	Fire Engine Crewman

U.S. Bureau of Land Management, Nevada State Office

JoLynn Worley	Public Affairs Specialist

U.S. Fish and Wildlife Service, Reno Field Office

Paul Barrett	Wildlife Biologist

University of Nevada Las Vegas, Harry Reid Center for Environmental Studies

Dennis Trexler	Director, Division of Earth Sciences

Nevada Division of Environmental Protection

Mahmoud Azad	Environmental Engineer

American Resources Corporation

Valerie Shelton	Project Manager
John Hayes	Mine Manager
Alan Hedley	Asst. Mine Manager

Empire Farms Inc.

Mike Stewart	Owner
Timoteo Guerrero	Farm Equipment Operator

Shuster Enterprises

Charlie Shuster	Trucking Contractor

Prepared by:

David Loomis (signature) 3-15-93

David Loomis, Environmental Planner,
Carson City District, Project Manager

Approved by:

Tom Leshendok (signature) MAR 23 1993

Tom Leshendok, Deputy State Director,
Mineral Resources, Project Sponsor

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